# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

| | COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Program Element (PE) Cost | 91280 | 71394 | 43639 | 24011 | 28840 | 40608 | 62469 | 59994 | Continuing | Continuing |
| D206 | Missile Simulation | 2847 | 2435 | 2775 | 2853 | 3067 | 3846 | 3656 | 3370 | Continuing | Continuing |
| D263 | Future Missile Technology Integration (FMTI) | 3834 | 5470 | 12056 | 6405 | 9439 | 2474 | 18302 | 16923 | 0 | 128192 |
| D380 | Multi-Platform Launcher | 11685 | 5879 | 4394 | 6532 | 7192 | 6709 | 0 | 0 | 0 | 63210 |
| D486 | Rapid Force Projection Simulation | 7806 | 5101 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26291 |
| D493 | Rapid Force Projection Demonstration | 34061 | 27712 | 17065 | 2604 | 0 | 0 | 0 | 0 | 0 | 111993 |
| D496 | Enhanced Fiber Optic Guided Missile (EFOG-M) | 26568 | 19943 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175488 |
| D549 | 2.75 Inch Anti-Air Technology Demonstration (TD) | 2661 | 2664 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5499 |
| D550 | Counter Active Protection System | 1818 | 2190 | 2005 | 1774 | 1772 | 2952 | 0 | 0 | 0 | 12689 |
| D567 | Low Cost Precision Kill (LCPK) for 2.75 Inch Rockets | 0 | 0 | 5344 | 3843 | 0 | 0 | 0 | 0 | 0 | 9230 |
| D655 | Hypervelocity Technology Demonstration (TD) | 0 | 0 | 0 | 0 | 7370 | 24627 | 24564 | 24525 | 0 | 78518 |
| D704 | Advanced Missile Demonstrations | 0 | 0 | 0 | 0 | 0 | 0 | 15947 | 15176 | Continuing | Continuing |

**A. Mission Description and Budget Item Justification:** This program element demonstrates application of mature advanced missile technologies to enhance U. S. Army force structure capabilities and existing assets. Major objectives for investigation are system deployability, lethality, survivability, flexibility and affordability. Work in this program element addresses the full spectrum of missile tactical missile roles and missions and is focused on upgrades to current missile systems. Efforts are conducted through system simulation/virtual prototyping, system design, hardware development and test, and demonstration in laboratory and operational scenarios. This program

element provides for the demonstration of advanced tactical missile enhancements and includes real-time hardware-in-the-loop simulation technology, multi-role fire-and-forget seeker technologies capable of locating targets in clutter, lightweight launcher improvements and enhanced rocket accuracy, advanced technologies for missile guidance, missile warheads, and hypervelocity missile technologies. This program element also provides full integration of battlefield technologies including hunters (forward sensors) and killers (weapons) integrated through advanced command and control. These components demonstrate a system of systems approach under the umbrella of the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) which addresses enhanced survivability and lethality for light, early-entry U.S. forces in a contingency role. The RFPI ACTD is supported by the Dismounted Battlespace Battle Lab (DBBL) with participation from the XVIII Airborne Corps. This program element also includes demonstration of the Enhanced Fiber Optic Guided Missile (EFOG-M). In the RFPI ACTD, EFOG-M fire units and missiles (with a limited manrating) participate in the RFPI ACTD field experiment and extended user evaluation. The work in this program element is consistent with the Army Science and Technology Master Plan, the Army Modernization Plan, Project Reliance, and supports multiple Defense Technology Objectives. This program element supports the U.S. Army Training and Doctrine Command (TRADOC) Battle Labs. Work in this program element is related to and fully coordinated with efforts in PE 0601104A (University and Industry Research Centers), PE 0602303A (Missile Technology), PE 0603238A (Air Defense/Precision Strike Technology), and PE 0603363F in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments.

| **B. Program Change Summary** | FY 1998 | FY 1999 | FY 2000 | FY 2001 |
|---|---|---|---|---|
| Previous President's Budget (FY 1999 PB) | 90468 | 86096 | 52466 | 30567 |
| Appropriated Value | 93839 | 71896 | | |
| Adjustments to Appropriated Value | | | | |
| a. Congressional General Reductions | -3371 | -502 | | |
| b. SBIR / STTR | -2192 | | | |
| c. Omnibus or Other Above Threshold Reductions | -724 | | | |
| d. Below Threshold Reprogramming | +3728 | | | |
| e. Rescissions | | | | |
| Adjustments to Budget Years Since FY 1999 PB | | | -8827 | -6556 |
| Current Budget Submit (FY 2000 PB) | 91280 | 71394 | 43639 | 24011 |

Change Summary Explanation: Funding - FY 1999 – Appropriated value reflects Congressional reduction for EFOG-M program.
FY 2000 - Funds realigned to higher priority programs (-8827).
FY 2001 - Funds realigned to higher priority programs (-6556).

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D206

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D206 Missile Simulation | 2847 | 2435 | 2775 | 2853 | 3067 | 3846 | 3656 | 3370 | Continuing | Continuing |

**Mission Description and Justification:** This project supports three separate but related tasks: (a) development, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities applicable to the evaluation of tactical missiles guided by signals in radio frequency (RF), millimeter wave (MMW), electro-optical (EO), and IR (IR) electromagnetic spectral regions. Evaluation by means of HWIL provides cost effective support to missile development throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. HWIL simulation employs actual missile guidance and control hardware operating in real-time in a non-destructive laboratory environment; (b) Distributed Interactive Simulation (DIS) via a node to the Defense Advanced Research Projects Agency (DARPA) Defense Simulation Internet; and (c) battlefield distributed simulation, which provides an all-analytical simulation of a weapon system engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscurants and disturbances. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are Boeing Defense and Space Group, Seattle, WA; and Nichols Research Corporation, Huntsville, AL.

**FY 1998 Accomplishments:**

- 1794
  - Completed development of the first stage of a computer-controlled precision signal measurement instrument (target verification monitor) for microwave and MMW radar HWIL simulation capabilities (currently supporting LONGBOW and PAC-3).
  - Integrated dichroic beam combiner, IR scene projection, and MMW signal generation technology for support of dual-spectrum (MMW/IR) HWIL simulation into a dual-spectrum HWIL simulation capability (applicable to BAT Preplanned Product Improvement (P3I) , Sense and Destroy Armor (SADARM), and Medium Extended Air Defense System (MEADS).
  - Implemented improvements to the temporal and spatial non-uniformity correction scheme for the IR laser diode array projector (LDAP) with a consequent improvement in overall projector performance (supporting Theater High Altitude Air Defense (THAAD), Enhanced Fiber Optic Guided Missile (EFOG-M), BAT P3I, Future Missile Technology Integration (FMTI).
  - Investigated application of spatial light modulators to IR scene projector technology as an alternative to LDAP and resistive element integrated circuit arrays with the objective of devising "leap ahead" IR scene projector technology.
  - Completed improvements to real-time dynamic IR scene generator software (benefits THAAD, BAT P3I, EFOG-M, FMTI).
- 1053
  - Modernized the Electro-Optical Simulation System for support of EFOG-M and FMTI.
  - Implemented upgrades to the AMCOM Distributed Simulation Center (DSC) real-time processing, data display and virtual prototype simulator.
  - Upgraded battlefield test bed capabilities to support DSC exercises with integrated live, virtual and constructive forces and commenced conversion to high level architecture (HLA) compliance.

Total 2847

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
|---|---|
| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology<br>PROJECT D206 |

**FY 1999 Planned Program:**

| | | |
|---|---|---|
| • | 1551 | - Continue the development of a HWIL simulation capability for dual-spectrum (passive IR and MMW radar) guided and sensor-fuzed tactical missiles and sub-munitions to support development of BAT P3I, SADARM PI, their successors, and other dual mode guided weapons.<br>- Upgrade IR scene projection capability by improving the laser diode projector performance and fabricating electronics for a resistive element chip of at least 512x512 pixel dimensions. Upgrade real-time target scene generator performance (frame rate and resolution) by adapting commercial off-the-shelf hardware and improved software to provide support to EFOG-M, THAAD, and other IR guided weapons.<br>- Continue development of "leap ahead" IR scene projector technology to overcome disadvantages of present laser diode and resistive element projector systems. This technology will support all development and test and evaluation (T&E) for all IR guided missiles and submunitions. |
| • | 823 | - Provide upgraded virtual prototype and real-time computer generated forces capability for the DIS Center, including improved accuracy and lower cost to meet R&D needs. Support conversion to HLA compliance.<br>- Implement upgraded battlefield distributed simulation test bed capability to provide improved control, integration, operation, data collection and analysis.<br>- Upgrade battlefield distributed simulation environmental models to support engineering evaluation of enhanced weapon system seekers/sensors. Support conversion to HLA compliance. |
| • | 61 | - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. |
| Total | 2435 | |

**FY 2000 Planned Program:**

| | | |
|---|---|---|
| • | 2075 | - Extend technology for dual-spectrum (passive IR, active MMW) simulation capability to support HWIL simulation of air and missile defense interceptor kill vehicles (applicable to MEADS and Atmospheric Interceptor Technology (AIT).<br>- Integrate HWIL capabilities for simulation of passive IR guided missile seekers and onboard tracking, guidance, and navigation processors with system ground equipment and test and evaluate physical environment conditioning simulators to apply and extend the principles of Simulation Based Acquisition to end-to-end missile system simulations (applicable to THAAD, National Missile Defense (NMD), AIT, and Antisatellite (ASAT).<br>- Integrate resistive element integrated circuits for IR scene projection with drive electronics and non-uniformity correction hardware/software (applicable to all IR missile seeker simulations). Implement into HWIL simulation capabilities.<br>- Implement improvements to MMW signal generation to support high-speed digital processing of intermediate frequency signals in the digital domain for radio frequency guided missiles and submunitions.<br>- Investigate means of implementing a HWIL simulation capability for active IR laser radar (LADAR) guidance systems (applicable to future LADAR guided systems).<br>- Develop a flight table-mountable LDAP IR scene projector to eliminate requirements for synthetic line-of-sight representation of missile-target relative motion in HWIL simulations (applicable to all IR guided missiles and submunitions). |

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
|---|---|
| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology<br>PROJECT<br>D206 |

**FY 2000 Planned Program: (continued)**

| | | |
|---|---|---|
| • | 700 | - Extend battlefield test bed and Distributed Simulation Center capabilities to support Simulation Based Acquisition principles and investigate future battle-fighting techniques via live, constructive, and virtual simulations.<br>- Upgrade software tools and virtual prototype applications to HLA compliance. Improve real-time computer-generated forces to support R&D requirements.<br>- Implement improvements in the synthetic battlefield environmental effects capability to represent actual conditions with greater realism. |
| Total | 2775 | |

**FY 2001 Planned Program:**

| | | |
|---|---|---|
| • | 2132 | - Complete the development of a dual-spectrum (passive IR, active MMW) simulation capability to support HWIL simulation of air and missile defense interceptor kill vehicles (applicable to MEADS and AIT).<br>- Continue the development of HWIL capabilities for simulation of passive IR (and dual spectrum) guided missile seekers and onboard tracking, guidance, and navigation processors with system ground equipment and test and evaluation physical environment conditioning simulators for end-to-end missile system HWIL simulations (applicable to THAAD, NMD, AIT, and ASAT).<br>- Develop technology components applicable to implementation of a HWIL simulation capability for active IR (LADAR) guidance systems (applicable to future LADAR guided systems).<br>- Demonstrate a flight table-mountable LDAP IR scene projector to eliminate requirements for synthetic line-of-sight representation of missile-target relative motion in HWIL simulations (applicable to all IR guided missiles and submunitions).<br>- Investigate and apply techniques for extending digital signal processing to signal generation of MMW radio frequency (RF) signals with the objective of improving HWIL simulator RF performance (bandwidth, sensitivity, low noise characteristics) to match or exceed developments in RF seeker technology. |
| • | 721 | - Further extend battlefield test bed and Distributed Simulation Center capabilities to support Simulation Based Acquisition principles and investigate future battle-fighting techniques via live, constructive, and virtual simulations.<br>- Increase realism and fidelity of simulated dirty battlefield in virtual simulation applications to support refined weapon system design, development, and technology insertions.<br>- Provide improved model fidelity for Army aviation and missile battlefield simulation applications to predict and evaluate weapon system performance with greater accuracy. |
| Total | 2853 | |

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D263

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D263 Future Missile Technology Integration (FMTI) | 3834 | 5470 | 12056 | 6405 | 9439 | 2474 | 18302 | 16923 | 0 | 128192 |

**Mission Description and Justification:** This project provides for the demonstration of advanced tactical missile technologies including seekers, propulsion, airframes, and guidance and control. The project will demonstrate lightweight multi-role missile technology in support of ground-to-ground, ground-to-air, air-to-air and air-to-ground missions. Combined flexible capability allows one system or variants of one system to replace many, realizing potential extensive savings in development costs, logistics, training, etc. Particular attention will be given to the development of IR seeker technology capable of long range lock, variable thrust propulsion allowing system range extension and thus stand off and high survivability, and the innovative use of radio frequency (RF) data links for identification friend or foe, and the attack of targets masked from the launch platform. The missile system demonstration includes the integration of guidance, control, propulsion, and airframe technologies capable of performing in high clutter/obscurants, adverse weather environments and under countermeasure conditions. Missile control and guidance system technology will explore capabilities such as lock-on before/lock-on after launch, fire and forget, command guidance, imaging IR signal and image processing, and wide band secure data links. The objective of the Modernized HELLFIRE Technology Effort is the demonstration and integration of dual or multi-mode seeker concepts, controllable thrust rocket motors (gels or pintle-controlled solids), automatic target recognition (ATR), and wide-band secure datalinks. Seeker technology will address imaging infrared, millimeter wave, and laser radar (LADAR) seeker technologies combined with the existing semi-active laser, in order to provide precision strike and fire-and-forget guidance modes without major modifications to the host platform. Affordable, controllable thrust rocket motors, such as gelled bipropellants or pintle-controlled solids, will be demonstrated to provide longer ranges and shorter flight times while increasing system robustness in the Air-to-Ground (ATG) and Ground-to-Ground (GTG) roles. ATR will be demonstrated permitting true fire-and-forget at targets beyond visual range. Finally, secure wide-band datalink hardware, allowing target position updates during missile flight, will be demonstrated. These efforts are a risk mitigation effort in support of a FY03 EMD start for Modernized HELLFIRE and are supported by the AGMS PM. This program will leverage technologies developed and demonstrated under the Future Missile Technology Integration (FMTI) program as well as the ongoing DARPA Advanced Fire Support System (AFSS) program and will be executed in two phases: 1) the first phase will conduct detailed analysis of the above technologies for maturity, packaging, risk, and cost. 2) The second phase will design, fabricate, integrate and test a prototype Modernized Hellfire missile through live-fire demonstrations as part of the AFSS program. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are Raytheon Company, Electronic Systems, Tewksbury, MA; TRW Space Electronics Group, Redondo Beach, CA; Loral Communications Systems, Salt Lake City, UT.

**FY 1998 Accomplishments:**

- 3834
  - Integrated and captive flight-tested seeker/autotracker/guidance and navigation computer at Elgin, AFB.
  - Completed component testing of gel-bipropellent propulsion system.
  - Completed integration of flight weight datalinks.
  - Demonstrated target hand-over to target acquisition system.
  - Qualification missile (shop clean missile) integration completed.

| | | |
|---|---|---|
| Total | 3834 | |

**FY 1999 Planned Program:**

| | | |
|---|---|---|
| • | 1457 | - Conduct detailed seeker trade studies to assess imaging IR, millimeter wave, and laser radar (LADAR) seeker technologies combined with the existing semi-active laser into dual-mode seeker that will fulfill Modernized HELLFIRE requirements.<br>- Develop detailed program plan.<br>- Evaluate seeker concepts for contract award. |
| • | 3868 | - Perform flight test of FMTI program and full-up missile including gel bipropellant propulsion system. |
| • | 145 | - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. |
| Total | 5470 | |

**FY 2000 Planned Program:**

| | | |
|---|---|---|
| • | 6306 | - Downselect to best Modernized Hellfire (Mod HF)/ Advanced Fire Support System (AFSS) Air-to-Ground (ATG) and Ground-to-Ground (GTG) seeker concept(s) based on FY 99 seeker tradeoff studies.<br>- Award contract(s) to design captive flight and missile flight seekers for integration on AFSS missiles. |
| • | | - Identify alternative Mod HF/AFSS seeker which offers higher payoff and greater risk than selected primary seeker. |
| • | 5750 | - Downselect to best controllable thrust rocket motor from competing gel and pintle-solid designs for Mod HF/AFSS ATG and GTG missions.<br>- Downselect to best Automatic Target Recognition (ATR) hardware and software which best meet ATG and GTG mission requirements for Mod HF/AFSS.<br>- Downselect to best datalink hardware design for in-flight target position update information. |
| Total | 12056 | |

**FY 2001 Planned Program:**

| | | |
|---|---|---|
| • | 4505 | - Complete hardware design and begin fabrication of seekers.<br>- Conduct bench and tower test of prototype seekers.<br>- Conduct hardware-in-the-loop testing.<br>- Integrate seeker with missile airframe.<br>- Begin preparations for seeker/missile flight test program. |
| | 1900 | - Complete controllable thrust motor development<br>- Conduct static test firings of controllable thrust motor<br>- Conduct captive flight test of ATR hardware/software<br>- Conduct tower test of guidance datalink |

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
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| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology<br>PROJECT<br>D263 |

Total 6405

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D380

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D380 Multi-Platform Launcher | 11685 | 5879 | 4394 | 6532 | 7192 | 6709 | 0 | 0 | 0 | 63210 |

**Mission Description and Justification:** The Multi-Platform Launcher (MPL) program explores and implements technologies to improve the deployability and lethality of the Multiple Launch Rocket System (MLRS) for counter battery, counter armor, and critical target missions. The first phase of the MPL program (Guided MLRS) designs, develops, and flight tests a low cost guidance and control system for the MLRS free-flight rocket, thereby substantially improving its delivery accuracy, reducing the number of rockets required to defeat the target, and expanding the set of MLRS targets to include precision targets. The guidance system will make use of inertial and Global Positioning System (GPS) low cost component technologies. A more accurate rocket results in both a more lethal force and a reduced logistics burden, which is especially important for early entry. This phase completes in FY 98 and transitions to EMD. The second phase of the program supports the design and testing of the High Mobility Artillery Rocket System (HIMARS), a C-130 transportable MLRS launcher, in the RFPI ACTD. The third phase of this program will demonstrate the technical feasibility of the MLRS Smart Tactical Rocket (MSTAR). This program will include provisions for dispensing multiple rounds of two submunition candidates from the MLRS Guided Rocket to achieve a precision strike capability for artillery rockets. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. The major contractor is Lockheed Martin Vought Systems, Dallas, TX.

**FY 1998 Accomplishments:**

- 4532 - Built one prototype and five flight missiles.
  - Conducted qualification test and flight acceptance test on 6 missiles.
  - Performed three Guided MLRS flight tests with inertial measurement unit (IMU) guidance at White Sands Missile Range (WSMR), NM.
  - Performed two Guided MLRS flight tests with GPS aided IMU guidance at WSMR, NM.
  - Transferred Guided MLRS technology to EMD.
- 6851 - Completed HIMARS design.
  - Fabricated HIMARS residual hardware.
  - Tested HIMARS hardware prior to firings, including electromagnetic testing, road tests, and man rating.
  - Tested firings of HIMARS at WSMR, including range costs.
- 302 - Small Business Innovation Research/Small Business Technology Transfer Programs.

Total 11685

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| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology |
| | PROJECT<br>D380 |

**FY 1999 Planned Program:**

| | | |
|---|---|---|
| • | 5755 | - Provide maintenance, spares, replacements, and repairs for HIMARS residuals, to be evaluated by the user as a part of the Rapid Force Projection Initiative Advanced Concept Technology Demonstration (ACTD) extended user evaluation.<br>- Provide Improved Position Determining System (IPDS) retrofit kits for residual hardware.<br>- Provide government furnished equipment to contractor.<br>- Provide support for interim HIMARS maintenance facility. |
| • | 124 | - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. |
| Total | 5879 | |

**FY 2000 Planned Program:**

| | | |
|---|---|---|
| • | 2500 | - Conduct MSTAR Requirements Analysis.<br>- Complete preliminary dispenser design.<br>- Coordinate comparability of ongoing submunition captive flight tests. |
| • | 1894 | - Provide support for residual HIMARS launchers. |
| Total | 4394 | |

**FY 2001 Planned Program:**

| | | |
|---|---|---|
| • | 5727 | - Complete detail design and engineering prototype MSTAR configurations.<br>- Conduct submunition dispenser design validation tests.<br>- Conduct air drop tests. |
| • | 805 | - Complete initial MSTAR system performance assessment. |
| Total | 6532 | |

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DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D486

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D486 Rapid Force Projection Simulation | 7806 | 5101 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26291 |

**Mission Description and Justification:** The Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD) Simulation Support Plan and the RFPI Study Plan provide a detailed description of the simulation and analysis efforts underway to support the RFPI program. Scenario development, force-on-force modeling, and simulation are currently supported by detailed engineering models, preliminary system performance estimates/data, and other system models and simulations provided by the RFPI program and the individual Advanced Technology Demonstrations/ Technology Demonstrations (ATDs/TDs). All simulations and analyses will be performed under the guidance and supervision of the Integrated Battlefield Simulation and Analysis Team (IBSAT). Simulations and analyses will support the determination of value-added proposed technologies for the RFPI ACTD and will be utilized to determine the mix and number of developmental sensors to be used in the Advanced Warfighting Experiment (AWE) and subsequently to determine residual quantities and support requirements. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. Major contractors are Computer Science Corporation, Huntsville, AL, and Nichols Research Corporation, Huntsville, AL.

**FY 1998 Accomplishments:**

- 1171 - Modified draft Ft. Benning scenarios for virtual rehearsal experiment to accommodate field elements.
  - Refined Ft. Benning terrain database.
  - Performed post-rehearsal model-experiment-model runs and analysis.
- 1752 - Performed final modifications to manned simulations.
  - Used manned simulators and semi-automated forces to provide rehearsal of ACTD experiment.
- 1739 - Performed final real/virtual hardware integration.
- 2732 - Integrated, prepared and executed ACTD experiment.
- 412 - Performed CASTFOREM tradeoff runs.

Total 7806

**FY 1999 Planned Program:**

- 969 - Provide virtual simulation resources to support real/virtual experiments during the residual period.
- 1551 - Apply RFPI technologies to excursion scenarios to include urban, varying terrain, weather, and countermeasures.
  - Perform post ACTD model-experiment-model runs and analysis.
  - Perform excursion runs and analysis.

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| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology |
| | PROJECT<br>D486 |

- 1745 - Provide support for manned simulator residual.

**FY 1999 Planned Program: (continued)**

- 713 - Perform final operational effectiveness analysis.
- 123 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 5101

**FY 2000 Planned Program:** Project not funded in FY 2000.

**FY 2001 Planned Program:** Project not funded in FY 2001.

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DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D493

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D493 Rapid Force Projection Demonstration | 34061 | 27712 | 17065 | 2604 | 0 | 0 | 0 | 0 | 0 | 111993 |

**Mission Description and Justification:** The integrated system of systems concept of this Advanced Concept Technology Demonstration (ACTD) provides lightweight, responsive precision fires to destroy threat armor forces during day, night, and adverse weather. The ACTD evaluates the value added by the insertion of these new technologies into the force structure of an existing light unit in a lift constrained environment. The inserted systems consist of forward sensors (hunters), advanced C2, and a suite of standoff killers. The mix of forward sensors used to complement and enhance existing unit assets includes both manned and unmanned air and ground systems. The sensor architecture is based on the unit equipment, as documented in the U.S. Army Intelligence Master Plan and the U.S. Army Modernization Plan, and is augmented with other sensors and processors, as required, to ensure forward sensors are properly cued. Tactical sensors (organic and advanced) receive cueing information from these sensors to rapidly focus them on targets. The mix of standoff killers complements and extends the capabilities of current systems. Howitzers are organic to the Division and Corps artillery and operate in direct and general support of the Maneuver Brigade. The lightweight and Highly Mobile Artillery Rocket and Missile System (HIMARS) rocket firing platform, which uses a wheeled chassis, will be a Corps asset which is attached to the Maneuver Brigade. The deployability of the FORSCOM unit will not be affected throughout the evaluation of the systems. The ACTD includes both simulation and field demonstration phases, and encourages user exploration of excursions from the baseline Tactics, Techniques, and Procedures (TTPs) to optimize utility of the standoff killers, forward sensors, and advanced C2 for the light forces. The RFPI ACTD field experiment was completed in 4QFY98, followed by an extended user evaluation of residual quantities. Integrated demonstration work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. Major contractors are Nichols Research Corporation, Huntsville, AL; and Computer Sciences Corporation, Huntsville, AL.

**FY 1998 Accomplishments:**

- 9529
  - Provided RFPI and Opposition Forces (OPFOR) instrumentation and support, including targets.
  - Provided communications support for experiment, including equipment spares/TAC radios.
  - Provided additional sensors and sensor support equipment.
- 12470
  - Developed hardware and software for special test instrumentation.
  - Conducted user training and perform installation and checkout of System-of-Systems experiment instrumentation.
  - Conducted large scale field experiment.
  - Prepared for residual support.
- 8951
  - Provided logistics support for ACTD.
  - Provided support for training and troops.
  - Provided support for residual hardware.

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
|---|---|
| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology |
| | PROJECT<br>D493 |

**FY 1998 Accomplishments: (continued)**

| | | |
|---|---|---|
| | | - Provided support for program evaluation and integration. |
| | 3111 | - Command and control technical demonstration for RFPI. |
| Total | 34061 | |

**FY 1999 Planned Program:**

| | | |
|---|---|---|
| • | 7085 | - Provide maintenance, replacement parts, and spares in direct support of user units. |
| | | - Provide spare batteries, cables, and other replacement parts for communications equipment. |
| | | - Provide RFPI integrated logistics support, personnel, analysis, and training. |
| • | 13920 | - Provide training on residual equipment for experiment units. |
| | | - Provide residual support for hunter/killer systems. |
| • | 6056 | - Provide analysis and red team support including countermeasure/counter-countermeasure analysis and preparation for possible milestone review. |
| • | 651 | - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. |
| Total | 27712 | |

**FY 2000 Planned Program:**

| | | |
|---|---|---|
| • | 11244 | - Provide support for residual RFPI elements. |
| | | - Provide training on residual elements to user units. |
| | | - Provide spares/replacement parts for residual elements. |
| • | 1921 | - Provide analysis and red team support, including support for possible milestone reviews. |
| • | 3900 | - Evaluation of select RFPI residuals in Joint Contingency Force (JCF) Advanced Warfighting Experiment (AWE). |
| Total | 17065 | |

**FY 2001 Planned Program:**

| | | |
|---|---|---|
| • | 1448 | - Provide support for residual RFPI elements including disposition. |
| • | 1156 | - Provide support to PEOs/PMs for RFPI element analysis/transition. |
| Total | 2604 | |

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D496

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D496 Enhanced Fiber Optic Guided Missile (EFOG-M) | 26568 | 19943 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 175488 |

**Mission Description and Justification:** EFOGM is the primary "killer" within the Office of the Secretary Defense (OSD) approved Rapid Force Projection Initiative (RFPI) ACTD. The EFOGM system is a multi-purpose, precision kill weapon system. The primary mission of the EFOGM is to engage and defeat threat armored combat vehicles, other high value ground targets, and hovering or moving rotary wing aircraft that may be masked from line of sight direct fire weapon systems. EFOGM is a day/night, adverse weather capable system that allows the maneuver commander to extend the battle space beyond line of sight to ranges up to 15 kilometers, thus reducing the exposure of the gunner and allowing targets to be taken out of the battle early. The system consists of a gunner's station, a tactical missile, and a fiber optic data link plus command vehicles. The missile can navigate to the target area automatically, and the gunner can intervene at any time to lock on and engage any detected targets. This gunner in the loop capability enhances the target acquisition process and minimizes fratricide and collateral damage. The gunner views the flight path and target via a seeker on the missile linked to the gunner's video console. The missile incorporates an IR imaging seeker and a variety of advanced targeting functionalities. The RFPI ACTD field exercise demonstrated airlift constrained, enhanced power projection capabilities through the development and evaluation of new technologies and tactics for early entry forces. This ACTD field exercise demonstrated a semi-automated target transfer from forward sensors (hunters) to an EFOGM weapon system (killer) using C3 integration and provide gunners and platoon leaders situational awareness not previously available. It explored the capability to expand the brigade level battlespace through the use of simulation, TRADOC Battle Lab warfighting experiments and demonstrations. The ACTD demonstrated the ability to conduct essential targeting and intelligence collection using forward sensors and real-time communications to provide for precision engagements against a variety of high priority targets, including armored vehicles. The EFOGM weapon system has been tested and qualified for sling load (UH-60L and CH-47D) to support all XVIII Airborne Corps light forces and will be qualified for low velocity airdrop qualified to support the 82nd Airborne Division.

**FY 1998 Accomplishments:**

- 11841 - Delivered 8 fire units, 2 platoon leader vehicles, 2 upgraded stationary simulators, and 3 developmental missiles (2 controlled test vehicle flight missiles and 1 guided test vehicle flight missile) for developmental testing and ACTD demonstration.
  - Conducted simulated missile flight operations, and live developmental missile flight test.
  - Participated in the RFPI ACTD field exercise.
- 3962 - Performed test planning, test facility/range operations, test data reduction, and provided targets and target support for simulated missile flights, and the developmental missile flight test.
  - Developed and conducted soldier training courses using tactical fire units, stationary simulators, and missile mass simulators, delivered operator equipment manuals, and conducted planning for hardware delivery and deployment.
  - Provided spares and repair parts and maintained hardware and software during testing, soldier training, and the RFPI ACTD field exercise.

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
|---|---|
| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology |
| | PROJECT<br>D496 |

**FY 1998 Accomplishments: (continued)**

| | | |
|---|---|---|
| • | 5068 | - Supported RFPI deployment testing and early entry lethality analyses.<br>- Provided engineering analyses support of hardware manufacturing and acceptance test. Supported hardware upgrade engineering analyses and design. |
| • | 5697 | - Programmatic and technical integrated product team support for engineering design, developmental test planning and conduct, cost and schedule control, affordability and producibility analyses, and risk management and mitigation efforts. |
| Total | 26568 | |

**FY 1999 Planned Program:**

| | | |
|---|---|---|
| • | 11037 | - Conduct 4 guided test vehicle developmental missile flight tests.<br>- Conduct warhead test, impact fuze sensor/propulsion evaluation, production flight readiness test, Lucent fiber qualification tests, engineering road test of fire unit/missile, and live developmental missile flight tests.<br>- Complete upgrade of the residual ACTD assets (8 fire units and 2 platoon leader vehicles) after completion of the ACTD field exercise.<br>- Continue systems support for ACTD hardware for the XVIII Airborne Corps.<br>- Evaluate tactics, techniques, and procedures and validate war fighting operations and firing doctrine. |
| • | 2185 | - Perform test planning, test facility/range operations, test data reduction, and provide targets and target support for simulated missile flights, developmental missile flight tests, and environmental, safety, transportability, and lethality testing. |
| • | 2542 | - Provide integrated product team support from a wide variety of functional areas.<br>- Provide facilities and support to development process, including hardware-in-the-loop, hardware/software integration and verification of system capabilities. |
| • | 3678 | - Programmatic and technical integrated product team support for engineering design, developmental test planning and conduct, cost and schedule control, affordability and producibility analyses, and risk management and mitigation efforts. |
| • | 501 | - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs. |
| Total | 19943 | |

**FY 2000 Planned Program:** Project not funded in FY 2000.

**FY 2001 Planned Program:** Project not funded in FY 2001.

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D549

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D549 2.75 Inch Anti-Air Technology Demonstration (TD) | 2661 | 2664 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5499 |

**Mission Description and Justification:** The objective of this project is to demonstrate the technology for a comprehensive upgrade to the STINGER missile system through the incorporation of an advanced imaging IR (IR) seeker to enable the engagement of hostile helicopters in clutter at extended ranges (2-3x). This project will demonstrate the ability to package the previously developed commercial breadboard signal processing electronics in a 2.75 inch diameter seeker. In addition, signal processing algorithms for target detection, tracking, and IR counter-countermeasures (IRCCM) will be developed and demonstrated via hardware in the loop simulations, ground tests, and captive carry tests. This seeker will maintain compatibility with existing STINGER launchers and retain STINGER's excellent capability against fixed wing aircraft. This program completes in FY 99. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

**FY 1998 Accomplishments:**

- 1570 - Completed form-factored seeker electronics.
  - Developed endgame and IRCCM signal processing algorithms.
- 1091 - Developed Hardware-In-the-Loop (HWIL) simulation.
  - Performed acquisition and tracking tests.
  - Performed IRCCM tracking tests.

Total 2661

**FY 1999 Planned Program:**

- 1500 - Complete endgame and IRCCM signal processing algorithms.
  - Complete HWIL simulation.
  - Perform HWIL missile flight simulations.
- 1102 - Develop platform/launcher interfaces.
  - Perform captive carry air-to-air tests.
  - Perform environmental tests.
- 62 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2664

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
|---|---|
| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology<br>PROJECT<br>D549 |

**FY 2000 Planned Program:** Project not funded in FY 2000.

**FY 2001 Planned Program:** Project not funded in FY 2001.

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D550

| COST (*In Thousands*) | FY1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY2004 Estimate | FY2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D550 Counter Active Protection System | 1818 | 2190 | 2005 | 1774 | 1772 | 2952 | 0 | 0 | 0 | 12689 |

**Mission Description and Justification:** This project will develop and demonstrate technologies which can be applied to Anti Tank Guided Weapons (ATGW) for improving their effectiveness against threat armor equipped with active protection systems (APS). Current technology development is concentrated in the following areas: radio frequency (RF) countermeasure (RFCM) technology for jamming or deceiving APS sensors used for detection, acquisition, and tracking; warhead integration and ballistic hardening of ATGW to reduce vulnerability to fragment impact. Develop and demonstrate sensors (salvage fuzing sensors) for detecting attack of anti-tank missiles by active protection munitions and firing the missile warhead before it can be destroyed. . Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

**FY 1998 Accomplishments:**

- 1818 - Completed CAPS dynamic field test apparatus.
  - Fabricated and test 2nd generation prototype jammer.
  - Designed 2nd generation testbed APS and buy long lead items for fabrication of test bed radar.
  - Completed integration of Soft Kill into midterm APS models.

Total 1818

**FY 1999 Planned Program:**

- 2142 - Complete 2nd generation test bed APS radar.
  - Fabricate, integrate, and test 2nd generation RFCM flight prototypes.
- 48 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 2190

**FY 2000 Planned Program:**

- 2005 - Fabricate APS munition test bed phase 1.
  - Conduct dynamic tests of salvage sensor breadboard.
  - Mature RF components for 3rd generation RFCM breadboard.
  -

Total 2005

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
|---|---|
| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology |
| | PROJECT<br>D550 |

**FY 2001 Planned Program:**

| | | |
|---|---|---|
| • | 1774 | - Fabricate selected salvage sensor prototype and dynamic sled tests against APS munition test bed.<br>- Complete APS munition test bed. |
| Total | 1774 | |

# ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

DATE: February 1999

BUDGET ACTIVITY: 3 - Advanced Technology Development

PE NUMBER AND TITLE: 0603313A Missile and Rocket Advanced Technology

PROJECT: D567

| COST (*In Thousands*) | FY 1998 Actual | FY 1999 Estimate | FY 2000 Estimate | FY 2001 Estimate | FY 2002 Estimate | FY 2003 Estimate | FY 2004 Estimate | FY 2005 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| D567 Low Cost Precision Kill (LCPK) for 2.75 Inch Rockets | 0 | 0 | 5344 | 3843 | 0 | 0 | 0 | 0 | 0 | 9230 |

**Mission Description and Justification:** This project provides for demonstration of a low cost, accurate (1-m CEP) guidance and control package for the 2.75-inch Hydra-70 rocket that provides a stand-off range ($\geq$ 6 km) capability against specified non-tank point targets. The retrofit guidance package will allow utilization of large existing Hydra 70 rocket motor, warhead, and fuze inventories. This capability will provide for a high single shot probability of hit (Ph$\geq$ 0.7) against the long range target, exceeding the current unguided 2.75-inch rocket baseline by 1 or 2 orders of magnitude and thereby providing a 4 to 1 increase in stowed kills at one third the cost per kill compared to current guided missiles. The resulting decrease in logistics burden is of significant benefit to a CONUS-based force projection Army and of particular importance in a rapid force projection scenario. In addition, the increased accuracy will minimize collateral damage, reduce risk of fratricide, and will reduce mission times and sorties resulting in increased system survivability. The program will demonstrate technologies and techniques to overcome barriers such as providing a low cost, producible strapdown mechanism for precision guidance; robust design for rolling airframe applications; component packaging in 2.75 - inch airframe; structural, vibration and shock considerations for guidance package retro-fit to current 2.75 - inch Hydra-70 rockets; and stand-off range target acquisition and engagement techniques to address current free-rocket launch and flight dispersions. Work will be performed by the Research, Development, and Engineering Center, U. S. Army Aviation and Missile Command, Redstone Arsenal, Al.

**FY 1998 Accomplishments:** Project not funded in FY 1998

**FY 1999 Planned Program:** Project not funded in FY 1999.

**FY 2000 Planned Program:**

| | | |
|---|---|---|
| • | 4000 | - Award contract(s) for design and fabrication of laser guidance package(s) and associated flight test support. |
| • | 1344 | - Perform ground launched control test vehicle flight tests, demonstrate stable airframe control. |
| | | - Upgrade and validate 6 degrees of freedom (DOF) simulation(s). |
| Total | 5344 | |

| ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit) | DATE February 1999 |
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| BUDGET ACTIVITY<br>3 - Advanced Technology Development | PE NUMBER AND TITLE<br>0603313A Missile and Rocket Advanced Technology |
| | PROJECT<br>D567 |

**FY 2001 Planned Program:**

| | | |
|---|---|---|
| • | 3500 | - Perform HWIL evaluations of contractor guidance section. |
| | | - Perform ground launched guided test vehicle flights of contractor guidance sections. |
| • | 343 | - Upgrade and validate 6-DOF simulation(s). |
| • | | - Support pre/post flight predictions/analysis. |
| Total | 3843 | |

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